

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. I
No. 1288

SATURDAY, MARCH 4, 1944
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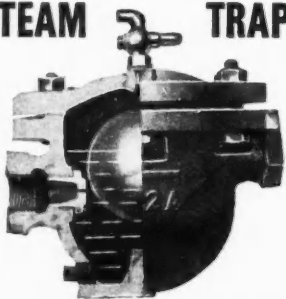
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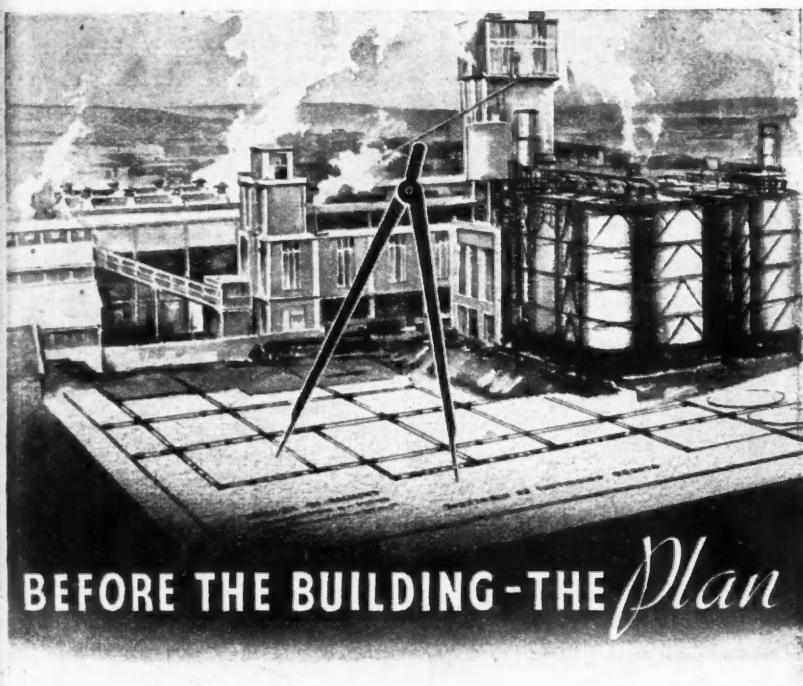
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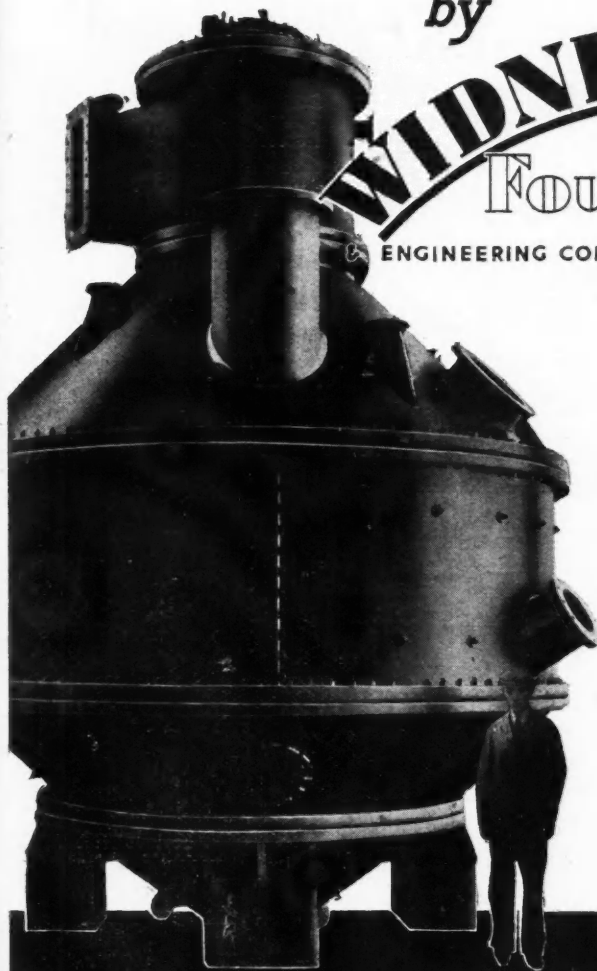
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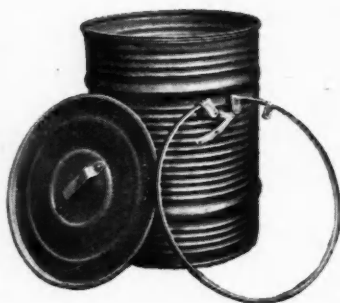
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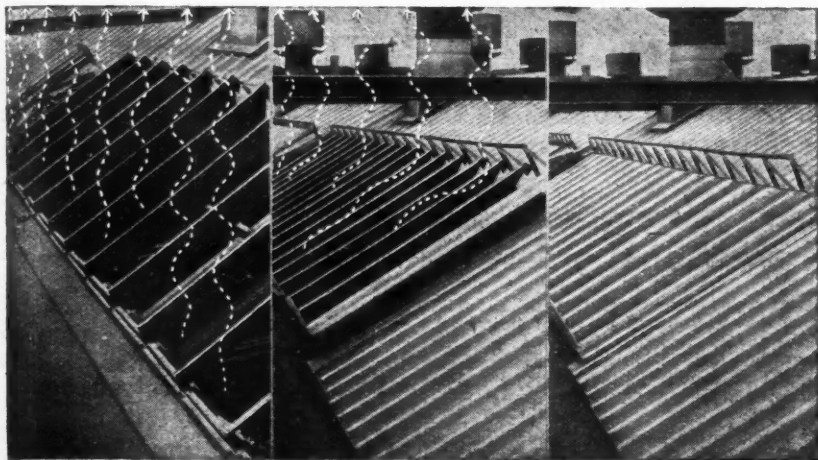
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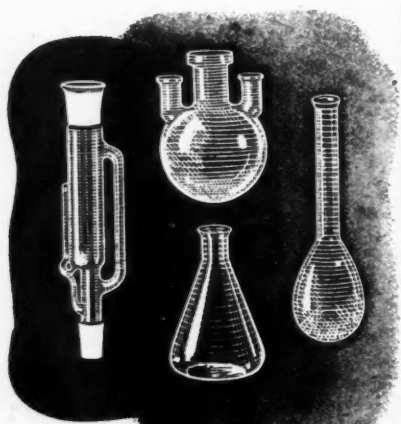
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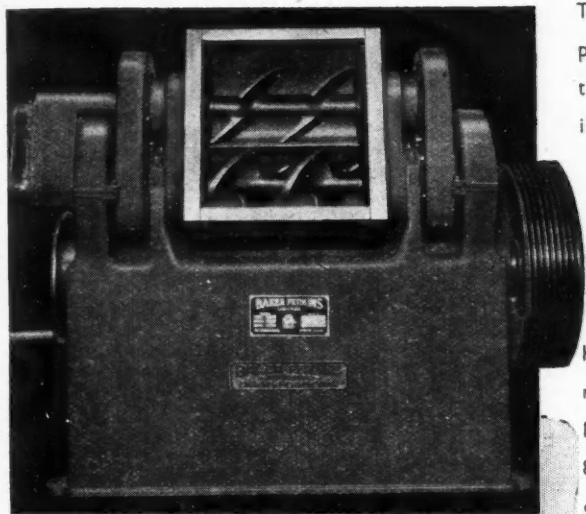
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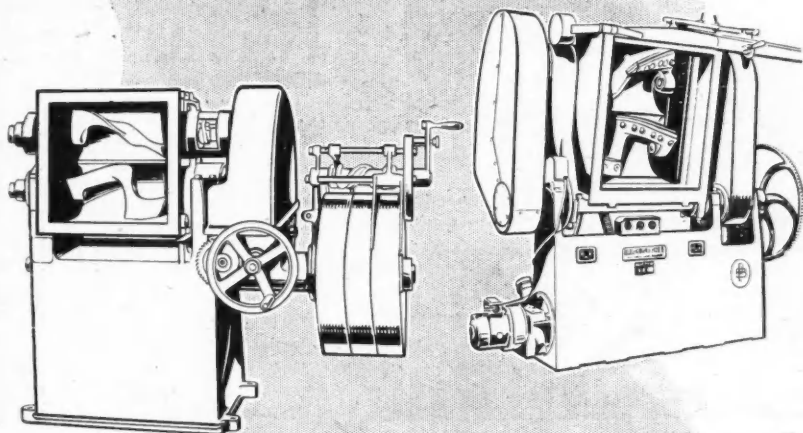
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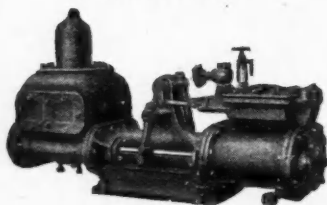


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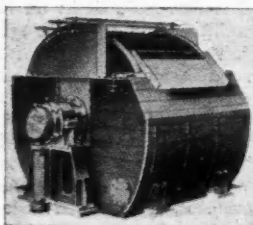
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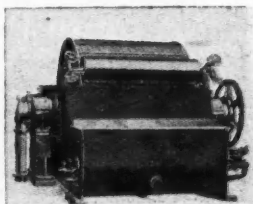
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Infra-Red Heating

THE merits of heating by infra-red radiation have long been known, and the greater rate of heat transmission by radiation from a source at a high temperature is an important factor in many industrial heating operations. Industrial furnaces are heated in two ways; by burning the fuel within the furnace and passing the gases through the heating chamber, or by burning it in a separate combustion space and not bringing the gases in contact with the goods being heated. The steam boiler is an example of the last-named method, and in it, although the heat is largely transmitted by radiation, the radiant heat is given to the boiler plate through which it must be transmitted by conduction: there may be no film resistance to radiation on the fire side of the plate, but there is the inevitable film resistance on the water side. Much chemical apparatus is heated in this way. In many furnaces, however, the heat is directly transmitted to the goods either by radiation from a flame formed inside the chamber proper, or by radiation from the hot brickwork. This method has been used for convenience and to obtain more rapid heating. It has been recognised that heat

can be transmitted by radiation at low temperatures, but the rate of transmission is then considerably lowered, so that convection and conduction are generally regarded as more convenient.

This conclusion has been challenged within the last few years, and considerable interest is now being taken in infra-red heating. This interest was started by Henry Ford, who found that wet paint exposed to infra-red radiation dried very much more quickly. This is the chief use for infra-red heating up to the present time. The rays appear to promote oxidation, but more especially to promote the polymerisation of certain paints which depend upon this reaction for hardening. Thus Andrew and Chamberlain in a recent paper to the Institute of Fuel have stated that when drying painted objects, in convector ovens, the time taken depends on the interval required for the object painted to reach the drying or curing temperature, and the characteristics of the paint. With thin metal sheets this may be about 30 min., but with heavy castings much longer; for example, a cast iron object weighing 14 lb. required 4 hours. With radiant heating the thin metal sheet only required

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40 sec., and the heavy casting 25 min., with the source of the rays at 650°F .; with the source at 1600°F ., the time required for the casting fell to 4 min. This result appears to depend partly on the absorption of infra-red radiation by the paint film, and partly on the heating of the base to which the film has been applied, by radiation that has passed through the film. Other applications are the drying of photographic film and impregnated cloth, of vegetable materials, drugs, tobacco, and textiles. In all these applications, the source of the radiation is placed so that it directly "sees" the object to be heated, thus essentially following the older furnace practice. The difference is that the source of the rays now used may be at quite a low temperature, often below red heat.

A new technique has been due to Mr. J. Arthur Reavell, who has described his work to the Institution of Chemical Engineers. This involves passing the radiation through a substance transparent (or translucent) to the rays. The lower the temperature of the source of the rays, the longer is the wavelength; thus, by adjusting the temperature, the wavelength can be controlled. Many substances, such as glasses, are partly transparent to infra-red rays over certain wavebands. If a heated body at the right temperature is so placed that its radiation impinges on a plate of fused silica, some 75 per cent. of the energy generated will pass through. It happens that liquids have also their characteristic curves of absorption, and matters can be often so arranged that the radiation that passes through the silica tube or plate will be wholly absorbed by a liquid on the other side of the plate. The advantage claimed for this method of heating is that the usual temperature gradients caused by film resistances are non-existent; figures given in Mr. Reavell's paper show that when evaporating water under vacuum by steam in a short-tube evaporator, if the steam is at 110°C ., the outer surface of the metal will be at 103.5°C ., the inner surface at 100°C ., and the water at 35°C . With a climbing-film evaporator, the respective temperatures will be 110° , 88° , 77° , 35°C . With the climbing-film evaporator heated by infra-red radiation, it is claimed that the temperature on the outer surface of the wall may be

atmospheric, and that on the inner surface of the wall will be only 35°C ., the same as that of the water, since there is no film resistance. This method has been applied primarily, we understand, to the evaporation and distillation of certain fine chemicals, the advantages being shorter time of exposure to the heat and in the avoidance of overheating at the film in contact with the tube. Some quite remarkable results have been claimed for this method, and it should have a wide application in certain fields.

It is at this stage a little difficult to forecast what the future of infra-red heating will be. The method of heating through a translucent material seems for the moment to confine that system within rather narrow limits, because the thicker the material, the greater the absorption of radiation by it. If, for example, the fused silica tube is increased in thickness to 4 mm., the absorption rises from 25 to 40 per cent.; the radiation absorbed must heat the tube, and it might be that a serious temperature difference would be set with these less satisfactory conditions that would cause the material heated to be spoiled. The fragility of the materials now available for transmitting the radiation might well limit the size of the apparatus severely. This method seems to require a good deal of development in various directions before it can be used for large-scale work, valuable as it is in the smaller-scale field of fine chemicals. It would seem for the moment that the most promising applications will lie in direct radiation in which the source of the rays "sees" the material heated. It could be imagined, for example, that a liquid could be evaporated in this way by a high-temperature source from above, the liquid being agitated to avoid the conductivity difficulty. One difficulty common to all methods is that if the source of the rays must be at a low temperature, the quality of the radiation may be satisfactory, but its total quantity may be very small, thus necessitating large apparatus with a very large radiating surface to provide the infra-red rays. Whatever may be its future, it is certain that a very interesting technique with important possibilities has been introduced into chemical engineering, and into other industries as well.

NOTES AND COMMENTS

Plastics and Tar

THE joint meeting of the Plastics group of the Society of Chemical Industry and the Association of Tar Distillers at Gas Industry House this week has served the useful purpose of providing a much-needed point of contact between the two industries. The tar distillers may have come away with the impression that the plastics people are highly ambitious and given to reaching for the moon, but at least they were shown which chunk of moon they might be able to supply to the new and rapidly developing industry. The tar distillers were not very vocal, but doubtless they went away with some new ideas about the potentialities of their industry as a source of new raw materials and intermediates. We hope the seed of co-operation between the two industries which was set at this meeting will germinate.

Coal Products Developed

A CONTRIBUTION from Dr. Levinstein, who took a prominent part in the discussion promised at the meeting, had the broad sweep that one expects from a synthetic chemist to whom all things are possible, and most things are practicable. Coal rather than coal-tar products was Dr. Levinstein's raw material. He stressed again the importance of carbide to the plastics industry, emphasising that without it we lack also the cyanamide needed for melamine resins. He then described how we could tap our resources of coal gas and coke-oven gas. The constituent hydrogen could be converted into ammonia, and thence to urea and the urea plastics. The methane, long the despair of the synthetic chemist because of its sluggishness, could yield methanol, formaldehyde, methyl chloride and acetylene. By the interaction of methane and ammonia the purest hydrocyanic acid could be prepared. He foresaw the conversion of the ethylene into ethanol, thus relieving us of the necessity to import molasses. But even when these gases and the liquid and solid tar products have been fully utilised, the plastics industry will still be short of raw materials.

Oil-Refining Demand

DR. LEVINSTEIN reckoned that it would take 10,000,000 tons of crude oil to make good the deficit, and in his emphatic demand for an oil-refining industry he was supported by Mr. Idris Jones. Dr. Levinstein concluded by comparing the position of the plastics industry to that which the dyestuffs industry occupied at the end of the last war. The most practicable form of protection which could be given to plastics would be a Government prohibition of imports except under licence. Another parallel with dyestuffs was mentioned by the chairman, Major Knowles, Tar Products Controller. He referred to the fact that anthracene, which British tar distillers provided during the last war, was bought abroad after the armistice. The tar distillers, we consider, are justified in wanting to know exactly what raw materials the plastics industry will require from them, and whether the new demands which the plastics industry is likely to make upon them in the near future will be maintained—another good reason why the two industries should maintain close contact.

Rayon after the War

IN an interim report issued by the Council of the British Rayon Federation last month, full consideration is given to the position of the British rayon industry in post-war years, and a strong case is made out for greater independence. While recording appreciation of the friendly attitude of the Cotton Board Committee, and emphasising the great importance that they attach to the effective and continuous co-operation of the two industries, the Council's report points out that the production of rayon and rayon staple is mainly a chemical process, to which no other textile industry offers any analogy. Increasingly large numbers of fibres new to the cotton industry will be developed after the war, and the need for special machinery to suit such fibres will likewise increase. Relations between the rayon industry and textile industries other than cotton will certainly become closer and more extensive, and problems of organisation should not be dominated by considera-

tions as to the cotton industry alone. In none of the other great rayon-producing countries is the principle maintained that the policy of one large textile industry should be determined by that of another. A hearty welcome, however, is given in the report to the stress laid by the Cotton Board on the importance of research. So far, no collective research has been organised for the rayon industry, except in so far as a number of firms have given support to the Shirley Institute with this end in view. The decision has been made that the rayon industry should create a research organisation of its own, under the control of the British Rayon Federation, keeping in closest touch with all other forms of textile research and with the D.S.I.R., so as to avoid overlapping.

Radium on the Screen

RECENTLY we drew attention to the important part that films have to play in telling the story of scientific achievement to the general public. A new film which will help to bridge the gap between the world of science and the man-in-the-street (and his wife) is *Madame Curie*. This is a screen biography not of one scientist but of two, and since the story comes to an abrupt conclusion very soon after the death of Pierre Curie it might have been more fittingly called "Marie and Pierre Curie." Eve Curie's book, upon which the picture is based, is very different from the average scientific biography in vogue in Britain. The film takes its lead from the book and attempts to convey details more intimate than those to which we are accustomed. But it is hardly a valid criticism to suggest that all the emotional passages in the book should have been left out of the film. Had this been done the result would have been a "documentary," and it is unlikely that the ordinary cinema-goer would have been prepared to sit through a documentary lasting two hours. The casting is excellent. We do not agree with those critics who think that Miss Greer Garson should have been made uglier, especially as Eve Curie stresses her mother's beauty as a young woman. The all-important laboratory sequences were supervised by Dr. R. M. Langer, of the California Institute of Technology, and so far as we could see they contained no technical blemishes.

The tedious research that led to the final triumph, the isolation of radium in the Curie's leaky ramshackle laboratory, is cleverly described, and the director effectively brings out the alternating moods of excitement and disappointment that all research workers experience. If the producers of this film set out with the idea of making the element radium a little less mysterious and the Curies more human than the public thought them, then they have succeeded.

Flash Steam and Process Vapour

ONE of the most important and encouraging "discoveries" of the fuel efficiency campaign is flash steam. It is a discovery only in the sense that a very large percentage of steam users have realised for the first time that flash steam is something which can be used, and that for many process and heating jobs it is every bit as good as virgin steam from the boiler, and sometimes better. Actually, flash steam is as old as industrial steam itself, but until recently it has normally been regarded in most places as merely a waste product of the steam plant. The recovery of process vapour has not quite the same novelty, for it has been done successfully in some industries for many years. Both subjects, however, deserve the close consideration of factory managements and engineers. Not only can they be responsible for very substantial savings of steam and hot water, but these can be put into operation at comparatively little cost and often with the simplest of plant re-arrangement. A new bulletin has come out explaining how flash steam and process vapour can be recovered and used instead of live steam. It is No. 28 of the Fuel Efficiency Bulletins issued by the Ministry of Fuel and Power. It is not long (as technical works go), but it is packed with really useful information. It gets right down to cases with practical examples of economies to be made by the use of flash steam and vapour recovery. After a brief explanation of how flash steam is given off by hot condensate, the bulletin then gives practical examples of common flash steam recovery systems in a variety of industries and services. Equally practical examples of simple vapour recovery follow, coupled with two very interesting cases of flash and vapour recovery from continuous boiler blow-down.

Activated Alumina

Its Properties and Industrial Applications

by J. HARWOOD, B.Sc., and W. CULE DAVIES, D.Sc., Ph.D.

PARTIALLY dehydrated hydrates of alumina have long been known to be active adsorbents and dehydration catalysts, and are now commercially termed "activated aluminas." A considerable patent literature exists on the preparation of alumina in suitable form for use as adsorbent and catalyst, but it was not until about 1932 that extended industrial use became possible. At about that time the Aluminium Ore Company in America discovered that the hard deposit that forms on the walls of the hydrate of alumina precipitating tanks could be graded into lumps which could, by suitable means, be rendered active. This new adsorbent soon established itself in the United States. More recently another method of manufacture of an activated alumina has been used by Peter Spence & Sons, Ltd., of Manchester, and their product is now available in granular form, ranging from powder to pieces of 1 in. across. This product is highly effective in adsorbing moisture from gases, vapours, and liquids. It is inert and permanent. The lumps do not break up even if they are immersed in water, and can be repeatedly reactivated by heat, without deterioration.

The three most important adsorbents in industrial use are activated carbon, silica gel, and activated alumina. The powerful adsorbing properties of activated carbon are well known, and its applications, such as for solvent recovery and removal of colour from solutions, are very familiar. Applications of silica gel (introduced in the early 1920's) as a drying agent, etc., are also widely appreciated. It is the purpose of the present paper to discuss activated alumina, the properties and applications of which are perhaps less widely known. On the whole, these three commercial adsorbents are not competitive products, each one having its own field of use, though, as will be expected, there is some overlapping. The uses of activated alumina are legion, and space precludes mentioning more than the most important lines along which research and development have progressed.

Activated alumina adsorbs moisture from air and other gases at practically 100 per cent. efficiency. Dew points of below $-60^{\circ}\text{C}.$ are readily obtained. During the period of practically complete removal of moisture (i.e., at 100 per cent. efficiency) activated alumina adsorbs from 18 to 20 per cent. of its own weight of water.* Adsorp-

tion, but with reduced efficiency, then continues until the alumina has increased in weight by 30 to 35 per cent. When saturated, the alumina is readily reactivated by heating to a temperature of between 175° and $250^{\circ}\text{C}.$ When the adsorbed moisture has been removed and the material has cooled to room temperature, it is ready for re-use. This cycle, of adsorption, reactivation by heat, and cooling, can be repeated indefinitely without any sensible deterioration or change in the properties of the adsorbent. Thus activated alumina has distinct advantages over the commonly used desiccants, such as sulphuric acid, calcium chloride, etc., which are more difficult to handle and are not readily reactivated for re-use. Table I gives a comparison of the desiccating properties of several well-known drying agents.

TABLE I.

Drying agent.	Water removed from air stream (%)
Alumina gel ...	99.9
Phosphoric oxide ...	97.8
Sulphuric acid ...	95.2
Calcium chloride ...	95.1

cf. BARNITT, DERR & SCRIPTURE, *Ind. Eng. Chem. Anal. Ed.*, 1930, 2, 355.

Amount of water non-adsorbed (in mg.) from 1 litre of air containing water vapour at the vapour pressure of $\text{Ba}(\text{OH})_2$, H_2O at 30.5° , using 100 c.c. of drying agent.

Copper sulphate anhydrous	2.8
Calcium chloride granular	1.5
Zinc chloride	0.98
Sodium hydroxide	0.8
Calcium chloride granular dehydrated	0.06
Silica gel	0.03
Alumina gel	0.005
Magnesium perchlorate	0.002
Barium oxide	0.00065

cf. BOWER, *Bur. Standards J. Research*, 1934, 12, 241.

Fig. 1 is a diagram of an apparatus which can be used to demonstrate the drying power of activated alumina. Air from a cylinder is saturated with water at room temperature in A and then passes through a tower of activated alumina C. The dried air then passes over a polished silver tube D containing a refrigerant (e.g., ether to which solid carbon dioxide is added) and a thermometer, and finally through a guard tower E containing a drying agent, and a gas meter. Under these conditions it was found that moist air (dew point 12° to $15^{\circ}\text{C}.$) could be dried to have a dew point

* These figures refer to the above-mentioned product of Peter Spence and Sons, Ltd.

of less than -80°C . (that is, there is no appearance of dew on the silver tube at -80°C .), even when the rate of flow was as high as 20 cubic feet per hour per lb. of alumina. The air continued to be dried (by 1 lb. of alumina) to this very low dew point for about 5 hrs. at this rate of flow.

Reactivation of the moisture-saturated

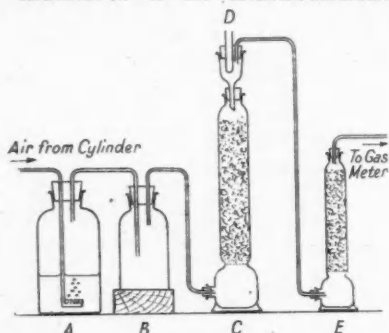


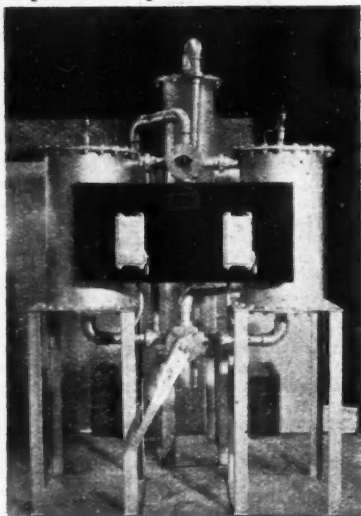
Fig. 1. Drying air by activated alumina.

alumina can be effected in several ways: for instance, by the use of embedded electrical resistance elements, by steam or hot oil coils, or by circulation of hot air or hot combustion gases.

In practice, for substantially complete drying, the height of the tower should be about four times the diameter. Though the heat of adsorption is rapidly lost, yet it is desirable in large towers to have provision for internal cooling, for water adsorption is most satisfactory below 30°C . The provision of internal cooling also enables a tower of alumina which has been reactivated by heating to be brought more quickly into use. Very large towers can be used, as the large lumps of alumina give but little resistance to the gas flow and have considerable mechanical strength. It is common in drying installations to employ two similar towers of alumina, one being in use, while the other is being reactivated. Drying installations are illustrated in Figs. 2 and 3. Such plants have been used for complete drying of gases, such as hydrogen, cracked ammonia, or natural gas, used as furnace atmosphere in the annealing and heat treatment of metals, thus preventing the formation of blemishes; the drying of air used in making sulphur trioxide; the drying of natural gas for prevention of freezing and corrosion in supply mains. Units for gases at high pressures (Fig. 3) are used for complete drying and removal of entrained oil after compression of the gas. In this way oxygen, hydrogen (for use in the hardening of oils), ammonia, carbon dioxide, carbon monoxide, sulphur dioxide, chlorine, nitrous oxide, nitrogen, methane,

propane, ethylene, helium, and argon may be dried. Chlorine, ammonia, and sulphur dioxide are themselves adsorbed to some extent on the alumina, which is, however, still effective for drying these gases, and can be regenerated.

For partial dehumidification of gases, e.g., in air conditioning, rapid flow rates (300 to 1000 cu. ft. per hour per lb. of alumina) are used. Fig. 4 depicts an air conditioning unit. For ideal manufacturing conditions in some factories and process rooms, conditioned air is desirable. Activated alumina units have particular advantages over refrigeration plants or methods using adsorbents which cannot readily be revived. Such units have been installed for providing conditioned air in processes for the manufacture of hygroscopic chemicals, sweets, pharmaceuticals, leather, and paper, all of which are injured by moisture. Further, conditioned air is supplied to storage rooms for steel products, sugar, and dried fruits, and for the maintenance of a relative humidity of about 5 per cent. in electrical-instrument testing shops. Conditioned air is best used for the evaporation of volatile solvents from certain products to prevent condensation of



[By courtesy of Birmingham Electric Furnaces, Ltd.]

Fig. 2. BAC 150 "Lectrodryer," employing activated alumina and electrical reactivation, for the continuous drying of gases at flows up to 1500 cu. ft./hour.

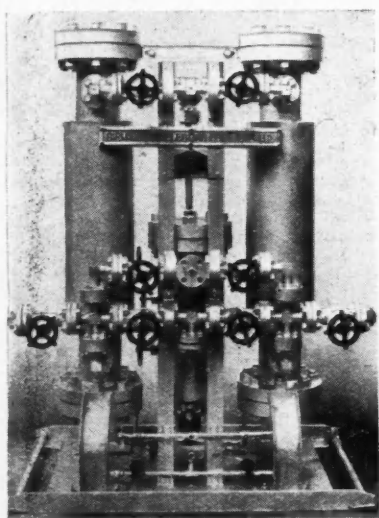
moisture. Oil storage tanks and transformers are often fitted with breathers containing activated alumina in order to prevent the ingress of moisture.

Activated alumina is effective for drying

many liquids, including the commercial refrigerant liquids, ammonia, sulphur dioxide, methylene chloride, carbon dioxide, and freon, and, of course, the vapours of these liquids. It has been employed to dry benzene, toluene, xylene, alcohols, carbon tetrachloride, carbon disulphide, etc. In many cases coloured impurities are simultaneously removed. In practice the liquid is allowed to percolate through a bed of the alumina, say, of 16/31 mesh grading, or finely powdered alumina is stirred with the

react with phosphorus pentoxide, may be dried by passing their vapours through activated alumina.

For drying solids which cannot safely be



[By courtesy of Birmingham Electric Furnaces, Ltd.]

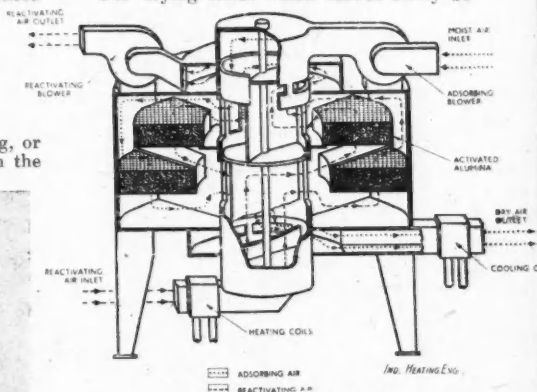
Fig. 3. HP BWC 10 "Lectrodryer" for the drying of oxygen at 2000 lb./sq. in., employing activated alumina with steam reactivation. An oil filter is included.

liquid, the alumina being subsequently removed by filtration.

A simple experiment can be set up to show the drying of ether which has been saturated with water by the use of activated alumina. The wet ether, which, if cooled in a freezing mixture, readily deposits ice crystals, is allowed to percolate once through a column of activated alumina. The take-off liquid cannot now be induced to deposit crystals, or even to become cloudy, when cooled to a temperature as low as -80°C .

For reactivation of the spent adsorbent it is sometimes necessary to assist removal of the absorbed organic liquids by application of diminished pressure as well as heat.

Compounds such as phosphine, and hydriodic and hydrobromic acids, which



[By courtesy of Birmingham Electric Furnaces, Ltd.]

Fig. 4. Air-conditioning unit. Diagrammatic section through a "Lectrodryer" showing sectors undergoing adsorption and reactivation.

heated, air dried by activated alumina is circulated over trays of the solid. An interesting development of this principle has been in the dehydration of meat and vegetables. Powdered solids can be dried by mixing with granular activated alumina, and, when the powder is dry, mechanically separating it from the alumina granules.

Activated alumina has a very high adsorptive capacity for many organic compounds. Table II gives the quantity of a number of organic vapours adsorbed at saturation, using the British alumina.

TABLE II.

Compound.	Percentage of its own weight of vapour adsorbed by activated alumina from air saturated with the vapour at 20°C .
-----------	---

Methyl alcohol	25.9
Ethyl alcohol	26.7
n-Propyl alcohol	27.1
iso-Propyl alcohol	24.8
n-Butyl alcohol	27.5
n-Amyl alcohol	25.6
iso-Amyl alcohol	26.4
Amyl acetate	30.3
Acetone	40.0
Formic acid	74.7
Acetic acid	74.7
Acetic anhydride	27.2
Benzene	27.0
Methylene chloride	43.1
Pyridine	36.0

It appears, therefore, that activated alu-

mina would be very suitable for the adsorption and recovery of a number of organic solvent vapours. It is not entirely suitable for acetone and acetyl chloride, where partial decomposition occurs at the surface of the alumina.

Oil Industry

Sulphur compounds, acidity, and coloured impurities are removed from crude mineral oils by contact treatment with activated alumina. Mono- and di-alkyl sulphides and mercaptans are more readily adsorbed than elementary sulphur and carbon disulphide. One of the major difficulties in the use of bauxite in oil-refining is due to its variable composition. Not all bauxites can be used and the suitability for refining purposes of a bauxite is not readily related to its chemical analysis. On the other hand, activated alumina possesses a greater activity than bauxite, and has a constant chemical composition. It thus appears that activated alumina may eventually occupy an important position as a refining agent in the mineral oil industry.

Colour, water, and undesirable substances are removed from waxes, molten or in solution, and resins, such as shellac, by treatment with activated alumina. It is also used for the purification of animal and vegetable oils; for instance, almost complete removal of objectionable odours from fish oils results from heating the oil with alumina.

An important application of activated alumina, particularly at the present time, is as an agent for the reconditioning of oils, especially of transformer oils. The usual methods of filtration remove sludge and water, but activated alumina also removes acid matter, producing a reconditioned oil of a high quality which is maintained for a considerable period. There are two main methods of procedure for the treatment of transformer oils. First, the oil in the transformer can be kept in good condition (a) by the attachment of a side container containing activated alumina, the oil slowly circulating through the alumina by thermosiphoning,¹ and (b) by suspending a small gauze basket or cotton bag of activated alumina inside the transformer casing (unpublished work of the Salford Electricity Department). Secondly, the oil can be removed from the transformer for treatment consisting of filtration or centrifuging to remove sludge and water, followed (c) by suspending trays of alumina in a tank of the oil, when reduction of the acid value is rather slow² or, (d) by continuous circulation of the oil through a bed of alumina, when reconditioning is rapid (Salford Electricity Department).

¹ J. E. HOUSLEY, *Elec. Eng.*, 1939, 58, 172, *Elec. World*: 1940, 113, 1521, 1576.

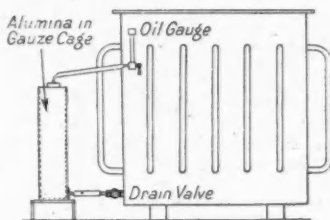
² J. L. FERNS, *Elec. Times*, 1942, 102, 824; *Petroleum*, 1943, 6, 34.

When exhausted, the alumina can be regenerated by heating to 350°-700°C. while passing through it a current of air, and after cooling in a current of air it is ready for re-use. The high temperature required to burn off all the oil does not appear to impair the activity of the alumina for further de-acidification of oils.

There is no doubt that transformer oils can be readily and economically reconditioned by means of activated alumina. Experiments on the recovery of other oils—switch, turbine, lubricating, etc.—are being actively pursued.

Chromatographic Adsorption

Fine grades of activated alumina have been utilised extensively in chromatographic adsorption separation. Such aluminas are used for separations from aqueous or non-aqueous solutions of organic and of inorganic substances. For any given separation, it may be necessary to test several specimens and types of alumina of different adsorptive capacity to get the best result. Generally a mesh grading of 100/200 is suitable, though many commercially available adsorbents have a much wider grading than this. A simple experiment to show the principle of the method of chromatographic adsorption separation can be performed as follows: an aqueous solution containing Victoria blue, methyl violet, and auramine is allowed to percolate slowly



[By courtesy of J. L. Ferns, Esq.]

Fig. 5. Side-container filtration method of conditioning while transformer is under load.

through a column of 100/200-mesh activated alumina (Spence's Type H) which has previously been washed through with water. Then water is again allowed to pass through the column to develop the separation. The alumina column now shows three bands of colour—the top one is due to the most strongly adsorbed Victoria blue, the centre one to the methyl violet, and the bottom one, a diffuse band, to the least adsorbed auramine. Thus, a separation of the mixture of dyestuffs has been effected.

It is not unlikely that this method, now

used as an analytical tool and for small-scale separations and preparations, may become an important industrial method for the separation of certain constituents of plant and animal products.

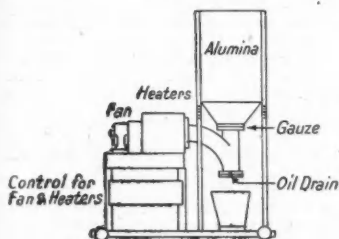


Fig. 6. Reactivation unit of Salford Electricity Department.

Activated alumina is used as an adsorbent for water and also for toxic substances in some types of gas mask. Carbon monoxide in air can be removed by catalytic oxidation to carbon dioxide, followed by alkali treatment to remove the latter gas. The presence of moisture in the air shortens the life of the catalyst. A layer of activated alumina is, therefore, inserted before the catalyst to dry the incoming air. In a series of tests it was found that, among the common drying agents, activated alumina had the greatest capacity and longest life. Use is also made of activated alumina as an adsorbent of poison gases in apparatus for the detection of such gases.

The convenient form, the high efficiency, and the ease of regeneration by heating to

and desiccators can be charged advantageously with this adsorbent. By using also a little of the indicator type of activated alumina (blue when the adsorbent is active, greyish-pink when spent) at the exit end of the drying tower, or on top of the adsorbent in the desiccator, a warning is given that it is time to reactivate the bulk of the alumina. Many applications of alumina as catalyst and catalyst-support have been described. It is proposed to describe these in a subsequent article.

Properties of Activated Alumina

The British activated alumina is practically pure aluminium oxide with a small amount of chemically combined and physically adsorbed water. There are small quantities of impurities, which, however, do not harm the product. Table III gives its average properties.

TABLE III.

Weight in lbs. per cu. ft.	40-42
Absorption of water at 100% efficiency	18-20%
Water adsorbed at saturation	30-35%
Apparent specific gravity	1.1
True specific gravity	2.6
Porosity	55-60%
Reactivation temperature	200-250°C.

Hardness: 100 g. of the alumina, 4/8 mesh, are tumbled at 60 revolutions per minute for four hours in a 16-oz. bottle attached to the edge of a rotating wheel, 28 in. in diameter. At the end of the period the granules are sieved, when the total of granules broken down is less than 1 per cent. This is a far rougher treatment than the alumina would be subjected to in actual

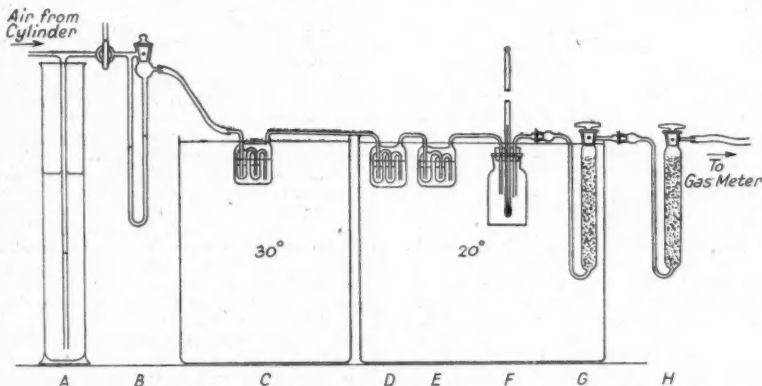


Fig. 7. Adsorptive efficiency of activated alumina.

200°-250°C., give to activated alumina a noteworthy place among laboratory desiccants. Towers charged with it can be used to prepare supplies of highly dried gases,

practical use; the mechanical strength of the activated alumina leaves nothing to be desired.

A method for obtaining the adsorptive

efficiency for water vapour is now described, as it is one of the best and simplest tests for determining the quality of an activated alumina. The flow of air from a cylinder is controlled by the device A and a flow meter B (see Fig. 7). The air is then passed through water in a bubbler C, kept at 30°C., and thence to a pair of bubblers D, E, containing water maintained at 20°C. The air, now saturated with water vapour at 20°C., passes through a trap bottle F to remove any liquid water and then into a U-tube G, packed with activated alumina (freshly reactivated) undergoing test. Both the bottle F and the U-tube G are kept in the 20°C. thermostat. The air escaping from G then passes through another U-tube H, packed with activated alumina impregnated with a cobalt salt to act as a moisture indicator, and finally through a gas meter. The air flow is adjusted to about 0.8 cu. ft. per hour (for 10 g. of alumina under test), and the U-tubes G and H are weighed at intervals. For convenience in assembling and dismantling, the U-tubes are provided with interchangeable ground connections. From the results the efficiency of the alumina can be determined graphically.

The alumina operates at 100 per cent. efficiency until 18-20 per cent. of its own dry weight of water has been adsorbed, after which it operates at reduced efficiency until 30-35 per cent. of its own dry weight of water has been adsorbed. These figures are maintained by the alumina after repeated reactivations. American workers have found no appreciable alteration after 1000 reactivations.

LETTER TO THE EDITOR

Coke from Peat in Russia

SIR,—I was greatly interested to read the Foreign News item regarding the above on page 174 of your issue of February 12. The experiments made exactly sixteen years ago in Russia with peat-coke were highly satisfactory: the coke was firm enough to be placed in medium high furnaces for iron reduction. The iron obtained was absolutely equal in quality to Swedish charcoal iron.

Particularly interesting in Russia was a treatment process, in which bog-iron ore was washed and formed with peat. The peat-iron briquettes thus obtained were very firm indeed; they dried very rapidly and stood after coking in the tallest furnace available in Russia at the time. I was unable further to pursue the work (which was sponsored chiefly by Stadnikoff) at the time, although I did hear of the very good results from reports which were later sent to me.

In every instance that I have been able to observe the use of peat-coke in the metal industry, the material was found to be superior to charcoal because it possessed greater density and an equally high capability of reaction in all cases of metal treatment thus proving its value.—Yours faithfully,

for FRANKS LABORATORIES, LTD.,
FRITZ FRANK, Director.

February 25.

British Industrial Plastics

The Year's Technical Progress

IN a statement circulated, as now usual, with the report and accounts of British Industrial Plastics, Ltd., before the annual general meeting (which was held on March 1), Mr. Kenneth M. Chance, chairman of the company, made interesting reference to technical progress during the year.

Most important was the great improvement they had made in their method of manufacturing moulding powders. How far that would ultimately take them it was as yet impossible to foresee, but they already knew that when they were able to add sufficient new plant for their new process they would effect great economies in cost of production coupled with an improvement both in quality and, in the case of coloured powders, consistency of shade, hitherto one of the most troublesome problems. At their chemical factory they had also solved the one feature in the manufacture of melamine which threatened to be difficult, and were satisfied that in their patented process they had the most effective and economical process for making that chemical yet known to the chemists of the world.

Mr. Chance also referred to their co-operation with Associated Insulation Products, Ltd., for complete union of their Beetle cement business with that of British Tego Gluefilm, Ltd. Tego Gluefilm was a bonding material, consisting of a film composed of thin paper impregnated with a phenolic resin. Its use in the manufacture of bonded plywood was cleaner and less wasteful of material than that of a viscous material such as Beetle cements, but it had the disadvantage that higher temperature and greater pressure were needed to set the gluefilm than were required for the cements. Such bonding materials were extensively used in the construction of Mosquito aircraft, and their technical experts were working towards a method of combining the best points of both materials.

Experiments necessary to future large-scale production of oil from shale are being carried out in Bulgaria, states the Minister of Commerce of that country.

AN liquid of the and t Febru M.I.M. began terist that is aln tion, rial to it. F that of the trans 40,000 trans strong and 50,000 Dif vary as sh The heati ment. Ford the s dryin this f tion is tr used the n to ut ticab ipven Th 120 110 100 90 80 70 60 50 40 30 TEMPERATURE °C (a) the c differ heate C

Infra-Red Radiation

New Application to Distillation Problems

AN interesting new technique that can be used for distilling and evaporating liquids was described to the joint meeting of the Institution of Chemical Engineers and the Society of Chemical Industry on February 8 by Mr. J. Arthur Reavell, M.I.Mech.E., M.I.Chem.E., F.Inst.F. He began his lecture by outlining the characteristics of infra-red radiation, pointing out that its absorption in most solid materials is almost instantaneous in time and position, and that it is the exception for a material to transmit the radiation or to reflect it. For most purposes it can be assumed that the radiation is absorbed on the layer of the material exposed. Silica, however, transmits infra-red in the range up to 40,000 Angström units. For water, the transmission is good up to 26,000 A.U., with strong absorption from 27,000 to 32,000 A.U. and some transmission from 36,000 to 50,000 A.U.

Different generators give radiations which vary as to the wavelength of peak emission, as shown in Table 1.

The specific use of infra-red radiation for heating and drying is a modern development, and it is generally accepted that the Ford Motor Company were the pioneers in the application of infra-red radiation for drying paint. Though the application of this form of energy for promoting evaporation has been almost entirely neglected, it is true that infra-red radiation has been used from very early times, as is seen from the number of inventions which have claimed to utilise solar radiation, though the practicability of many of these suggestions and inventions is highly dubious.

The application of heat by this means for

methods of evaporation or distillation the whole of the useful heat is transmitted to a tube or vessel, and is then conducted to the liquid under treatment through the walls of

TABLE I—WAVELENGTH, TEMPERATURE, ENERGY, AND TYPE OF GENERATOR

Wave-length peak emission in A.U.	Temperature of generator C°.	Energy per ft. ² of generator surface in B.Th.U./hr.	Type of generator
10,000	2700	1,300,000	Electric lamp
14,000	2000	450,000	Electric lamp
20,000	1200	80,000	Electric lamp
21,000	1100	62,000	Electrically heated rods
25,000	875	28,800	Gas panels and electric rods
30,000	700	14,400	Gas panels and electric rods
35,000	550	7500	Gas panels and electric rods and discs
47,000	340	2400	Large surfaces gas heated vapour and liquid heated tubes
50,000	300	1800	Ditto
55,000	250	1350	Ditto

the vessel. With infra-red radiation the liquid is inside a container which is translucent to the infra-red radiation, the source of this radiation being outside the container. As a result heat is absorbed directly into the liquid *without intermediate heat-transfer by the walls of the container*. This difference is reflected in the different temperature gradients that are shown in Fig. 1. By using infra-red and making the tube wall of a material that transmits this form of radiation, it is possible to obtain an entirely new set of evaporating conditions in which there is no contact of the liquid under treatment with a surface at a relatively high

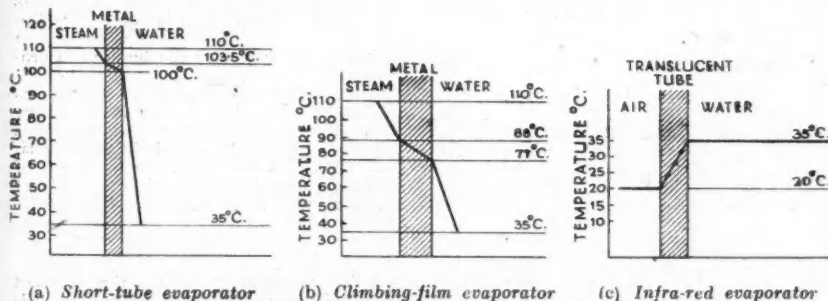


Fig. 1. Temperature gradients for three types of evaporator.

the evaporation and distillation of liquids differs fundamentally from that of steam, heated fluids, or hot gases. In normal

temperature; in fact, the enclosing tube is heated by the liquid and not the reverse.

For the successful application of this tech-

nique the essential requirements are a source of radiation of correct wavelength distribution, a tube constructed in silica or other suitable material which will transmit radiation at the wavelength used, and a turbulent flow of liquid. By interposing between the infra-red generating surface and the evaporating tube an evacuated space of non-absorbing gas whose function is to obviate effects due to conduction or convection, the normal resistance of the stagnant film of the conducting medium is eliminated. For example, using a generator with a peak emission of 23,000 A.U., 75 per cent. of the total energy can be transmitted through silica. With the elimination of the temperature gradients inevitable in any normally heated evaporator or still, and by the utilisation of the climbing-film principle, a practical means of continuous evaporation is made possible for even the most thermolabile biological extracts, such as penicillin filtrates.

The infra-red evaporator (shown diagrammatically in Fig. 2) has enabled liquors to be evaporated which previously could not be concentrated except by a lengthy and laborious process, either by prolonged heat-

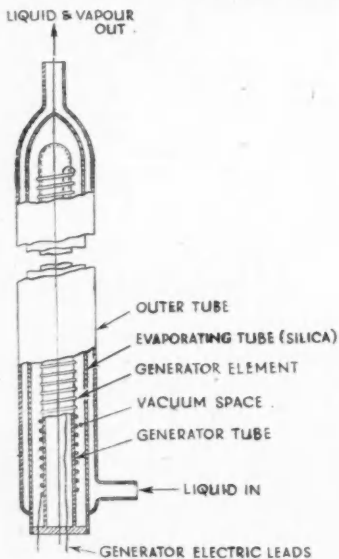


Fig. 2. Diagrammatic arrangement of infra-red generator for Reavell patent evaporator (internal type).

ing in a water bath, or by the method of freezing and evaporating in an ultra-high vacuum. Both methods take 24-48 hours to complete a batch, and involve the use of

very bulky and expensive apparatus, whereas in the infra-red evaporator the process is continuous and the time of contact is only a fraction of a second.

Fig. 3 shows the diagrammatic arrangement.

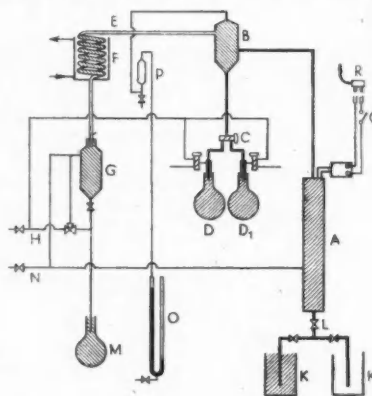


Fig. 3. Diagrammatic arrangement of infra-red laboratory evaporator (Reavell patents).

[A, Generator unit; B, Separator; C, Condenser; D & D₁, Concentrate receivers; E, Vapour tube; F, Condenser; G, Condensate collector; H, Auxiliary vacuum lines; I, Electric control; K, Feed vessels; L, Feed control valve; M, Condensate receiver; N, Main vacuum lines; O, Mercury manometer; P, Condensate trap; Q, Single pole switch; R, Three-pin plug.]

ment of one simple type of infra-red evaporator with condensing and liquor-collecting system. With this system ordinary tap water is sufficient to cool the condenser, unless recovery of low boiling point solvents is required, when the condenser can be ice-packed quite easily. Any normal system such as a water ejector can be used to produce the vacuum, and it has been found that one of the advantages of this apparatus is that an ultra-high vacuum is not necessary. The apparatus can be made with glass contacts throughout, so that the most sensitive liquids can be handled without fear of metallic contamination, and conditions of absolute cleanliness and sterility easily maintained.

A full statement regarding the proposed oil pipeline from the Saudi Arabian oilfields to the Mediterranean has been promised by Mr. Edward Stettinius, Acting U.S. Secretary of State. He says that the U.S. has already discussed the pipeline question with the British authorities.

Metallurgical Section

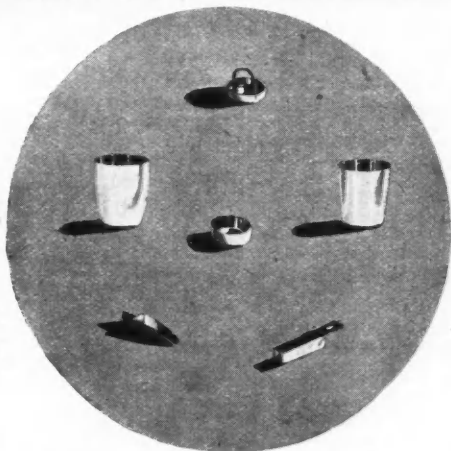
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Metallurgical Section

March 4, 1944

Light Alloys After the War Development of Markets in Britain

A SURVEY of the position of Light Alloys in Post-War Britain was presented to the Royal Society of Arts last month by Mr. E. C. Goldsworthy, Development Officer of High Duty Alloys, Ltd., the primary aim of which was to indicate how light alloys might play their part in achieving the ideal of full employment which is regarded as the main guarantee of lasting peace and social security. Beginning with a short historical account of the development of aluminium, Mr. Goldsworthy showed how this was related to the fall in price. Before 1890 the metal was employed in its virgin state for ornamental work of various kinds, but the rapid fall in price, and the development of oxy-acetylene welding, enabled it to be utilised for vessels, etc., in the food and chemical industries. The first demand for alloys was for castings, and came with the advent of the automobile industry; and the alloy market was vastly expanded with the evolution of the aeroplane and the vital need for reduction in engine weights.

Effects of the Aircraft Industry

Market development has been slower in Britain than in many other countries. Mr. Goldsworthy points out that this was partly due to political considerations, while it was further handicapped by the comparatively small aluminium and aluminium alloy industries. Castings were developed in the early years of the century, but it was not until the 1920's that wrought alloys got into their stride. The exceptional needs of the aircraft industry from 1930 onwards retarded normal development in other directions, and one effect of the war was that practically no staff or facilities were available for market research. Nevertheless, the light alloy industry remains confident that it can contribute usefully to the problems of peace. After the war (as Sir Stafford Cripps has said) a large proportion of the aircraft industry will be available for the manufacture of products other than aircraft. The vast industrial potential thus released, can be used in (i) the re-establishment of pre-war markets; (ii) the creation of markets needing a minimum of development; and (iii) the opening up of new markets requiring extensive research and development.

Light alloys should not compete except in suitable markets, where their special qualities can be applied. The major markets, therefore,

will be in transport (air, road, rail, and marine), in portable or semi-portable structures, and in fittings for buildings or machinery where movement is an essential factor. Though the volume of the aircraft industry will decline, it will still remain important, on account of the need for replacing obsolete types; but greater development can be looked for in the field of road transport, both commercial and passenger, notably in public transport vehicles and the higher-priced private cars. The railway industry might well make greater use of light alloys than in the past, but no large turnover to aluminium can be expected until there has been a substantial period of research and practical development. In shipbuilding, alloys of aluminium have made substantial though restricted advances in the marine industry of this country, especially among small craft. Light alloys in the superstructure of steel ships, not only reduce weight but, by virtue of the lower elastic modulus, reduce the stress concentration, as Mr. W. Muckle has recently pointed out in a paper to the North-East Coast Institution of Engineers and Shipbuilders. Mutual appreciation of problems, as between shipbuilder and the light alloy industry, will obviate a repetition of the use of wrong alloys for certain purposes, as has been not unknown in the past. An increased use of light alloys for standard power units in vehicles of all kinds can be looked for—a logical development from their use in the construction of aircraft engines.

Civil Engineering

In the civil engineering field there will be a world-wide demand for aluminium in the construction of bridges, port and harbour facilities, ropeways, long-span cranes, and all light portable structures, and the technical liaison between the civil engineering and light alloy industries should create a market eventually, though this will depend to a great extent on economic considerations. In the chemical and food industries a replacement, to some extent, of the pure aluminium hitherto in use, by an increasing quantity of aluminium alloys may be anticipated, in view of the demand for strength and the development of the weldable corrosion-resistant alloys.

It is firmly believed that light alloys can contribute substantially to the post-war building programme, especially in buildings (such as

schools and hospitals) where cleanliness and ease of movement are essential. Endowed with light weight, corrosion-resistance, ease of cleaning, and freedom from warping, aluminium alloys satisfy all the requisite conditions. A considerably increased demand for domestic appliances after the war can also be expected; and this will be assisted by the improved technique of colour anodising, whereby a range of fine colours can be dyed into the metal with approximately the same fade-resistance as is met with in fabric materials.

Magnesium Alloys

Many of the markets suitable for aluminium might equally well make use of the alloys of magnesium. These have an advantage in their lower specific weight, but are less corrosion-resistant unless the expensive high-purity magnesium ingot is used to make up the alloy.

A point of general interest raised by Mr. Goldsworthy is that as aluminium ingot has to be imported into this country (although from within the Empire), it is essential to develop an export market to pay for the material. The major industries will therefore be called upon to supply a considerable export demand if their products are not merely dependable, but equal to, or better than those of other countries. A stimulant to meet these many and various requirements may well present itself in the tremendous post-war demand for essential goods which cannot be met by other industries or other raw materials. The light alloy industry, appreciating the position, is ready to co-operate in any advantageous research programme, and the Wrought Light Alloys Development Association has been formed to give this assistance to all users of light alloys. For this work it has the full co-operation of the leading firms in the industry and can call on them for assistance.

The development of markets is dependent mainly on the availability of suitable alloys, and on the price. In Great Britain the production of ingot aluminium is handicapped by the high cost of electric power and the almost complete lack of good bauxite; fortunately, however, there are vast reserves of good bauxite in Canada, and abundant cheap power; and production of aluminium has become a factor in the economic stability of Canada (see THE CHEMICAL AGE, February 5, page 159). The price of aluminium in Canada to-day is 15 cents (say 8d.) per lb., but it is stated on good authority that the estimated price of virgin metal sold in this country post-war is 6d. to 6½d. per lb. Under present methods of production, it is doubtful whether aluminium could be produced and sold in this country under 8d. per lb., but it is possible that, if the post-war demand is sufficiently large, fabrication costs will be considerably reduced, so that, taking into consideration the estimated price of Canadian ingot after the war, industry can look forward to a reduction of 25 to 30 per cent. on the pre-war alloy components.

Parliamentary Topics

Iron Ore to Germany

IN the House of Commons last week Major Stourton asked what was the tonnage of iron ore exported by Sweden to Germany since the outbreak of war, and also the percentage increase of these exports for each of the war years. The Parliamentary Secretary to the Ministry of Economic Warfare said that the total exports since the start of 1940 amounted to about 34,000,000 tons. Compared with the average exports in the four years 1935-38, the percentage increases were as follows: 1940, 15%; 1941, 2½%; 1942, 4% decrease; 1943, 15% increase. Total exports for the four war years to enemy countries other than Germany and to enemy-occupied countries were about 3,000,000 tons. Mr. Foot added that there had already been considerable reductions in Swedish trade with Germany, and under this year's trade agreement Swedish iron-ore exports to the Axis were to fall from 10 to 7 million tons.

Empire Copper

Answering a question from Sir H. Williams, Mr. Peat, for the Ministry of Supply, said that the proportion of British copper supplies obtained from Empire countries in 1943 was 62 per cent. It was estimated that the proportion in 1944 would be 70-73 per cent.

RESIN BINDER FOR MOULDING SANDS

Use of a pinewood resin has speeded the production of armour steel castings for tanks by smashing a foundry-sand bottleneck, reports The Hercules Powder Co., of America. Faced with a scarcity of the specially-graded silica sand used in cores and moulds, foundries have greatly increased their use of mechanically reclaimed old sand by mixing it with a pulverised resin. Before the war, production of each ton of cast steel usually required half a ton of new sand. By using the resin, one foundry, turning out 5000 tons of steel castings monthly, has cut its new sand requirements from 2500 tons to 600 tons. The resin, which is mixed with either new sand or sand mechanically reclaimed after casting, binds the sand grains together to form the core. The sand core must be strong enough to resist the molten metal when it is poured into the mould, and the binder must be destroyed by heat after casting to permit easy removal of the sand from the core cavity. The resin core binder bakes faster than other types of binder, and has been found especially effective with sands containing clays.

The Spanish Metallurgical Industries

II.—Future of the Steel Industry

(From a Special Correspondent)

(Continued from THE CHEMICAL AGE, December 4, 1943, page 556)

AMONG the leading Spanish iron and steel manufacturers, some work on a large scale, but these are exceptional, and the usual productive capacity of a plant is about 300-400 tons of pig iron per day. This compares with the 1000 tons daily output of the furnaces in England, Germany, and North America; or with the still larger plants in Russia, such as that of Magnitogorsk which has a daily output of 1500 tons. From several points of view, as Señor Millán points out in his review, conditions in Spain are not suitable for such large units. In addition to the difficulties already referred to, such as lack of suitable coke and declining quality of native ore, there is the uncertainty of a sufficient market whether at home or abroad.

A Large-Scale Concern

Nevertheless, there is at least one Spanish firm comparable to some of the largest in Europe, and that is the well-known Soc. Altos Hornos de Vizcaya, with a capital of 250,000,000 pesetas, and works at Baracaldo, Sestao, and Sagunto. There are eight blast furnaces in all, each of 400 cu. m. volume, with a total annual capacity of 700,000 tons of iron and a still larger output of steel. The company makes its own coke, together with by-products and derivatives, and has well equipped works for the manufacture of steel products, forgings, stampings, etc. Also it possesses large coal mines and valuable deposits of iron ore, through its various subsidiaries, e.g., Hulleras del Turón (Asturias), Compañía Minera de Decido (Santander), and its shares in the Orconera Iron Ore Co. It has its own fleet for the transport of coal and ore. The plant at Sestao has lately been completely modernised and enlarged, with a total capacity of 1000 tons cast iron per day, from the three furnaces in action and a fourth under construction. The Baracaldo plant in recent years has yielded nearly 700,000 tons; but, as Millán says, this is small compared with some of the larger continental works. In this plant a new furnace of Swiss manufacture has lately been erected, and in 1939 it was decided to instal at Sestao one of the German Brassert type, the same as those used at the Hermann Goering works—one of the largest in Europe. Altogether since 1937 the Vizcaya firm has installed several new blast furnaces and modernised its Martin-Siemens steel works at Sestao, together with auxiliary plant. At Baracaldo it has also ex-

tended the steel plant, including a Siemens-Maerz furnace of 90-100 tons capacity, the largest in Spain, in which powdered dolomite from Crespi is used with good results. Rolling mills have been installed at Sagunto, as well as capacity for other manufactures, including tin plate production up to 40,000 tons a year.

The Soc. Metalúrgica Duro Felguera, of Asturias, is the second largest metallurgical firm in Spain, and has a capital of 125,000,000 pesetas. Although its principal activity is coal-mining, it has in recent years devoted considerable attention to the manufacture of iron and steel. It is aiming at an ultimate annual production of 60,000 tons of cast iron and 70,000 tons of steel. Its equipment includes a new Brassert furnace of 474 cu. m. volume capacity.

Other Spanish iron and steel firms, with a capital of between 20 and 40 million pesetas, include: Fabrica de Mieres, a Catalonian concern; Cia. Anon. Basconia, at Bilbao; Soc. Ind. Asturiana "Santa Barbara" with works at Moreda and Gijón; Nueva Montaña, at Santander; S.A. Echevarria and Patricio Echevarria, at Santa Agueda and Bilbao; and Cia. Auxiliar de Ferrocarriles, at Beasain (Guipúzcoa), the last mainly engaged, as its name implies, in the manufacture of railway rolling stock. Numerous other smaller firms operate in the Basque Provinces and Santander.

New Discoveries Needed

Señor Millán comments on the large capital expenditure that is necessary for metallurgical enterprise and the comparatively low returns thereon. In the case of Spain it would seem that, the law of diminishing returns is operating with increasing force as regards the iron ore deposits; and in the absence of new discoveries the quality of the ore must continually decline, as indeed it has done in recent years. Nevertheless, so far as the immediate future is concerned, the writer is fairly optimistic and looks forward to the time when Spain will be independent of foreign resources, including coke and iron and steel scrap. He recalls that the founders of the Spanish iron and steel industry, as far back as 1782, offered a prize of 600 *reals* (a considerable sum in those days) to the foundryman who could produce 50 quintals of iron with the maximum economy, also a silver medal to the ironworker who could show the most efficient methods of iron or steel manufacture. It

is even more essential to-day to encourage in this way the development of the most economical methods of steel production, with a minimum consumption of coke.

The Instituto Nacional de Industria, specially set up to study Spanish industrial problems, has been largely occupied since its inception with the idea of making Spain independent of foreign countries, at all events in iron and steel manufacture. Apart from other work in this field, such as the provision of larger supplies of native coking coal, the Instituto has given close attention to the possibilities of the Renn-Krupp process in Spain, with a view particularly to overcoming the difficulty of an almost complete lack of imported scrap. To this end a technical mission was sent to Germany to study the process in detail.

Renn-Krupp Process

The Krupp-Renn process—or Renn-Krupp as they call it in Spain—was introduced by Johannsen in Germany in 1934. Large rotary furnaces, like cement kilns, are used, up to 4.2 m. in diam. and 70 m. in length. The ore or metal is therein reduced to a pasty condition, and at a temperature below the m.p. of the iron is converted into carbon-poor compact lumps embedded in slag, from which, after cooling, they are separated by crushing. The greater part of any phosphorus present in the ore passes into the iron, while manganese goes largely into the slag. The sulphur content will vary with the basicity of the slag. With fairly high-grade ore it would seem advantageous to produce low-sulphur lumps, by means of suitable additions to the charge, with a view to direct production of steel. With poor ores, on the other hand, especially if high in silica, it is better simply to prepare the lumps and charge them afterwards into a blast furnace for conversion to pig iron and removal of sulphur.

In Spain the method was regarded as a means of obtaining foundry scrap (*chatarra artificial*) and had the additional advantage of being workable without high-grade metallurgical coke; could indeed be used with almost any sort of fuel, such as low-grade high-ash coal, lignite, anthracite, powdered fuel, etc.; and was also particularly suitable for low-grade iron ores. Fuel consumption ranges from 25 to 35 per cent. of the weight of ore according to its iron content.

Since it is possible to utilise both low-grade ore and low-grade fuel, the method at first sight looked very attractive to the Spanish iron-makers, and cheap. But the actual installation is, in fact, very expensive. In view of the comparatively high content of sulphur and phosphorus in Spanish ores, the iron lumps obtained in this way would have an undesirably high percentage of these two objectionable elements; and if

passed to the Siemens or electric furnace would involve an increased use of ferromanganese, thus aggravating existing difficulties. There would also, it seems, be more severe wear and tear on equipment, under Spanish conditions, and generally the cost of producing the iron lumps would be high; even though, by adoption of this process, Spanish production of iron and steel might be increased by more than 30 per cent. It was therefore decided to instal a trial plant in Vizcaya with the threefold purpose of economising in consumption of coke, meeting the shortage of imported scrap, and utilising to best advantage the carbonate and silica ores, together with the anthracites of Palencia.

The writer discusses at some length the possibilities in Spain of sintering, a somewhat older and better known method which has been adopted on a huge scale in Germany, though it is not to be assumed that the conditions there are quite the same as in Spain. Señor Millán believes that the method is well adapted to Spanish ores, containing as they do a fairly high proportion of sulphur and phosphorus, and more especially for dealing with the carbonates. He points out that, in the U.S.A., with a 35 per cent. content of sintered material in the furnace charge, the coke consumption is less than 18.5 per cent. and output is increased by 25 per cent. In Germany, with 50 per cent. agglomerate in the furnace charge, there is a saving of coke to the extent of 250 kg. per ton of iron produced, and an increase in output of 28-34 per cent. Taking the Spanish output figures for 1940 as 580,376 tons of cast iron, requiring 678,000 tons of coke; and allowing for a saving in coke of 230 kg. per ton by sintering, then, with the same consumption of coke, the production of iron could be increased to 725,000 tons.

It is further suggested, with the same object of economising coke consumption, that serious study should be made both of the Sturzelburg process—for direct manufacture of special grade iron and of steel in a rotary furnace—and of the Norwegian (Tysland Hole) method, using a special type of electric furnace.

(To be concluded)

Exploitation of the titaniferous deposits of Spain is being actively carried on, according to Dr. J. Barceló (*Ion*, 1943, 25, 485), the principal concerns interested being Industria Titán, S.A., of Barcelona, and Sociedad Titania, S.A., in Galicia. Ilmenite sands are recorded in the Sil river (Galicia) and in the Sierra Nevada, while titanomagnetite (iserine) has been found near Olot, in the Pyrenean foothills north of Barcelona. Sands in the Canary Islands have also been analysed. The TiO_2 content of all these deposits varies between 20 and 25 per cent.

Personal Notes

DR. LESLIE H. LAMPITT has been elected a member of the Council of Birmingham University.

MR. CHARLES R. PARSONS has been appointed a director of Barry and Staines Linoleum, Ltd.

MR. K. L. SUTHERLAND has been awarded the Rennie Memorial Medal for 1943 by the Australian Chemical Institute for his work on principles and methods of flotation.

Obituary

MR. JOHN D. ATHEY, late secretary of the Textile Institute, died on February 18.

The death is announced of MR. ROBERT THOMSON, proprietor of M. F. Findley & Co., explosives merchants, Cadogan Street, Glasgow.

MR. WILLIAM CLARDY LUSK, who died on February 25, following an operation, in London, was chairman of the British Thomson-Houston Co., Ltd., and deputy-chairman and managing director of Associated Electrical Industries, Ltd.

MR. CHARLES EDWARD TYERS, who died at Virginia Water, Surrey, on February 18, had long been associated with the industrial and social life of Widnes. He was an expert in alkali manufacture, and rose to be manager of the Muespratt Works of the United Alkali Company. During the last war he was in charge of the works when they were on all-out essential production, and in 1920-29 he served on the Widnes Town Council, being appointed chairman of the Gas and Water Committee in 1927.

DR. JACQUES BRODBECK, who died at Gstaad, Switzerland, on February 20, was president of the Society of Chemical Industry in Basle (Ciba), and, until September last, was chairman of the Clayton Aniline Co., Ltd., Manchester. Dr. Brodbeck took a leading part in the development of the dyestuffs industry in the United King-

dom through his most active association with the Clayton Aniline Company from 1911. He became a director of the company 25 years ago and was elected chairman in 1930. He was also a director of Ciba, Ltd., Horsham, the establishment of which factory was due to his enterprise. Dr. Brodbeck also took a paramount part in extending the Swiss dyestuffs industry, and exerted far-reaching influence on the pharmaceutical development of Ciba, Basle.

DR. LEO HENDRIK BAEKELAND, the pioneer of Bakelite, died in New York on February 23. Born in Ghent, Belgium, in 1863, he graduated at the University of Ghent, where he was assistant chemistry professor from 1882 to 1889. In the latter year he emigrated to America, and in 1893 he founded a chemical company to manufacture photographic papers, including the well-known Velox paper of his own invention. In 1899 he sold this concern to Eastman Kodak, and devoted his time to research work. For the Hooker Electrochemical Co., he helped to develop the Townsend electrolytic cell. The phenol-formaldehyde resin known as Bakelite was discovered by him in 1909, and was named after him. He was president of the Bakelite Corporation during the period 1910-1939. He rendered great services to the Government of his adopted country; in the last war, for instance, he served as a member of the U.S. Nitrate Supply Commission and presided over the National Research Council's patents committee. He was considered an authority on the subject of patent reform. The importance of his researches was recognised throughout the world not only by scientific bodies but also by Governments. His many awards included the A.C.S. Nichols and Willard Gibbs Medals, and the Franklin Medal. A member of the Society of Chemical Industry since 1898, he was awarded the American section's Perkin Medal in 1916, and the Messel Medal in 1938. He was an honorary member of the Royal Society of Edinburgh.

General News

Isinglass is being tested in Britain as a substitute for human blood plasma. Canadian scientists have found it gives good results and no signs of toxic effects.

The Institute of Physics announces the election of 24 new fellows, and 54 associates. Nineteen Australians are included in this list.

Before the forthcoming debate in Parliament on research, there will most likely be issued a White Paper setting out the present organisation for all branches of scientific research in Great Britain.

From Week to Week

The Minister of Food last week declined, on security grounds, to give the prices f.o.b. paid by his department for palm oil imported from Africa.

The Ministry of Labour is collecting statistics to show the present number of qualified scientists and technologists in Britain.

Plastics are used to a greater extent, it is claimed, than in any other aircraft, in the Proctor IV wireless training or communications machine, which has lately been removed from the secret list.

The Board of Trade has, with the approval of the Treasury, decided that in respect of the six months beginning April 1, 1944, and ending September 30, 1944, the rate of premium payable under any policy issued under the Business Scheme shall continue to be at the rate of 5s. per cent.

A fire which broke out on Monday in the grinding shop of W. H. Cowburn & Cowpar, Ltd., chemical manufacturers, Trafford Park, Manchester, took over two hours to master. Members of the N.F.S. engaged in fighting the fire wore special breathing apparatus to protect them from sulphur fumes. No one was injured.

The Trading with the Enemy (Specified Persons) (Amendment) (No. 2) Order, 1944 (S.R. & O. 1944, No. 138) contains the names of 110 concerns in neutral countries with whom dealings of any sort are unlawful. The list includes Química Española, S.A., Méndez Alvaro 57, Madrid, and Chemisch-Technische Werke A.G., Bitzen,enstr.44-66, Muttentz, Switzerland.

Foreign News

A report on penicillin, giving directions for its manufacture, has been microfilmed in America and will be shown to China where large-scale production is to be started by the Chinese industrial co-operatives.

Iodine sales of the Chilean Nitrate Corporation for the year ended June 30 will amount to 1113 tons, it is reported, as against 967 tons the previous year, and a further increase is expected in the current year. Nitrate sales dropped from 1,371,000 tons to 1,243,000.

Canadian distilleries are now restricted entirely to the production of alcohol needed in war industries. More than a year ago all distilleries were enlisted in war production, but the plants were still able to turn some of their capacity to the making of potable products. The authorities now say that the need for industrial alcohol is so great that the distilling of beverages must cease.

An offer to reduce shipments of wolfram to Germany to a token minimum and supply the rest to the Allies is reported to have been made to the U.S. Government by General Franco. The Americans have prepared a list of new economic sanctions to be applied if the present oil embargo proves ineffective. It has been decided to continue the oil embargo through March.

Additional power for the Shawinigan Water and Power Company's system has been provided by the installation of two new units on the St. Maurice River, Quebec. One of these augments the capacity of the Rapide Blanc generating station from 160,000 to 200,000 h.p.; the second increases that of the La Tuque station from 178,000 to 222,500 h.p.

Forthcoming Events

The British Association of Chemists, London section, meets in the Chemical Society's rooms, Burlington House, W.1, on **March 4**, at 2.30 p.m., to hear a lecture by Dr. T. J. Drakeley, principal, Northern Polytechnic, on "Training for the Chemical Industries."

The South Wales section of the **Society of Chemical Industry** meets on **March 4**, at 3 p.m., at University College, Swansea, to hear a lecture by Mr. E. Leighton Holmes on "The Properties and Applications of Organic Ion-Exchange Materials, with Special Reference to Water."

The **Institution of the Rubber Industry**, London section, meets on **March 6**, at 6.30 p.m., at Caxton Hall, S.W.1. Dr. C. F. Flint will deliver a paper on "Synthetic Latexes" and Mr. E. W. Madge, B.Sc., will talk on "The Extension and Substitution of Natural Latex."

The London section of the **Society of Chemical Industry** meets at 2.30 p.m. on **March 6** in the rooms of the Chemical Society, Burlington House, W.1, to hear a paper by Mr. C. M. Whittaker on "The Application of Dyestuffs to the Newer Synthetic Fibres."

Professor A. R. Todd is giving two lectures to the **Royal Institution** on "The Mode of Action of Some Vitamins." These are arranged for **March 7 and 14** at 5.15 p.m.

The next meeting of the Midlands Centre, **Electrodepositors' Technical Society**, will take place at the James Watt Memorial Institute, Birmingham, on **March 7**, at 5.30 p.m., when a paper on "Electrolytic Polishing of Metals" will be given by Mr. S. Wernick.

The seventh set of **Fuel Economy Lectures**, arranged jointly by the A.B.C.M. and the B.C.P.M.A., will be held on **March 8**, at 2.30 p.m., in the lecture hall of the Royal Society of Tropical Medicine, 26 Portland Place, London, W.1. The subjects will be "Stills" and "Distillation." Brief introductions by Mr. S. J. Ralph and Mr. W. H. A. Webb (both of Aluminium Plant & Vessel Co., Ltd.), respectively, will be followed by discussions on personal practical experiences and questions will be welcomed. Non-members of the Association are invited to the meeting and should notify Mr. A. J. Holden (The Association of British Chemical Manufacturers, 166 Piccadilly, London, W.1) not later than March 6 of their intention to attend.

Mr. I. C. P. Smith, B.Sc., A.I.C., is lecturing on "Sintered Glassware—its Manufacture and Uses" to the **Pharmaceutical Society**, 17 Bloomsbury Square, W.C. 1, on **March 9** at 7 p.m.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH ALUMINIUM CO., LTD., London, E.C. (M., 4/3/44.) February 9, disposition by Grangemouth Co-op. Bldg. & Investment Soc., Ltd., with consent of Mrs. I. E. Grigor or Singer and the co. granted in implement of a Trust Deed dated September 12, 1934; charged on Dencroft, 19 South Broomage Avenue, Larbert, and fittings, etc. *£3,312,318. April 13, 1943.

NORMAN EVANS & RAIS, LTD., Manchester, colour and chemical manufacturers. (M., 4/3/44.) February 9, two mortgages to Midland Bank, Ltd., each securing all moneys due or to become due to the Bank; charged on 2 Summerlands, Dudley Road, Whalley Range, Manchester, and Outwood House, Cheadle Bulkeley, Handforth, with machinery, etc. *Nil. June 8, 1943.

Chemical and Allied Stocks and Shares

THERE was again only a small amount of business passing in the stock and share markets, and following the renewal of air raids on London there has been a fairly general easing of prices of industrial and kindred shares. Nevertheless, declines on balance have been small, and subsequently the rather lower prices tended to attract buyers. Sentiment was assisted by the absence of any heavy selling and by other indications of confidence in the future. Only fractional movements were shown in British Funds.

Shares of chemical and kindred companies were relatively steady. Imperial Chemical at 38s. 4½d. were a firm feature, and were better on balance in view of confidence that the forthcoming announcement will show maintenance of the dividend at 8 per cent., and the not unattractive yield of over 4 per cent. Borax Consolidated remained at 37s. 9d., and British Aluminium kept at 47s. 9d. Results of the last-named company are due shortly, as are those of General Refractories, whose 10s. shares at 16s. 3d. have lost the rise shown a week ago. International Paint have been steady at 115s. since publication of the preliminary results, showing maintenance of the dividend at 20 per cent. Furthermore, Lewis Berger held their recent further rise to

98s. On the other hand, there has been a reactionary tendency in a number of shares of companies mainly identified with the London area; Gas Light & Coke ordinary, for instance, were 18s. 10½d. compared with 20s. 6d. a week ago, although the lower price now appears to be attracting buyers.

British Oxygen (80s. 6d.) were the same as a week ago, and Dunlop Rubber remained at 40s. 6d., while Murex kept at 101s. 10½d., and Turner & Newall showed further improvement from 80s. to 80s. 6d. B. Laporte were again 75s., and W. J. Bush 60s. There was, however, a reaction from 43s. 6d. to 43s. in Boots Pure Drug, and Lever & Unilever eased from 36s. 6d. to 36s. Associated Cement at 63s., and British Plaster Board at 29s. 9d. were unchanged on balance. Triplex Glass at 36s. regained part of an earlier decline. At 32s. United Molasses were slightly below the level of a week ago. The units of the Distillers Co. were 89s. Following the dividend announcement, Dorman Long moved down to 26s. 4d. Stewarts & Lloyds at 54s. 1½d. were virtually unchanged on balance, as were Tube Investments at 96s. 3d., Guest Keen at 34s. 3d., Staveley at 49s. 6d. 4d., Consett Iron at 7s. 6d., United Steel at 24s. 1½d., and Richard Thomas at 9s. 6d. Elsewhere, Allied Ironfounders have been firm at 49s. 3d., while Amalgamated Metal were 17s. 7½d., and Goodlass Wall improved further to 17s. 3d.

Following the announcement of lower profits and the maintenance of the dividend at 7½ per cent., Courtaulds reacted to 51s. 9d. 4d. British Celanese at 27s. lost part of their recent improvement. On the other hand, hopes that the forthcoming results may show resumption of dividends were reflected by further improvement to 21s. 6d. in Bradford Dyers. Calico Printers ordinary were again 16s. Among plastics, De La Rue moved back to 152s. 6d., Erinoid were higher at 11s., and British Industrial 2s. ordinary kept at 6s. 9d. prior to the annual meeting. United Glass Bottle were again 60s., and Forster's Glass 10s. ordinary remained at 31s. 3d. In other directions, Wall Paper deferred units were steady at 38s., as were Barry & Staines at 44s., and Nairn & Greenwich at 68s. 9d. Imperial Smelting eased to 13s. Monsanto Chemicals ¾ per cent. preference were 23s., and Blythe Colour 4s. ordinary 9s. 1½d. Burt Boulton kept at 22s. 6d., and Cellon 5s. ordinary at 23s. Sangers eased from 24s. 1½d. to 23s. 10½d., and Timothy Whites from 32s. 9d. to 32s. 6d. Greeff Chemicals Holdings 5s. shares were 7s. 3d., at which the yield is 7 per cent. on the basis of the 10 per cent. dividend paid for 1942. British Drug Houses ordinary were 23s., while Leeds Fireclay preference were easier at 16s. Most movements in oil shares have been small: Anglo-Iranian were 113s. 1½d. compared with 112s. 6d. a week ago.

British Chemical Prices

Market Reports

SATISFACTORY trading conditions have been reported from nearly all sections of the London general chemicals market and a steady volume of new business is in evidence, with values firm. The supply position for several materials still leaves much to be desired, with no prospect of an early improvement. In the soda products section, fair quantities of industrial refined nitrate of soda are being taken up and prices are well held, while both the solid and liquid grades of caustic soda continue to be absorbed in good quantities against contracts. Glauber salt fully maintains its firmness and is meeting with a steady demand, and satisfactory quantities of salt cake are being called for. Contract deliveries of both soda ash and bicarbonate of soda keep at a reasonably good level and there has been no quotable change on balance in the hyposulphites of soda. Supplies of bichromate and chlorate of soda are being steadily absorbed and quotations remain unchanged. Among the potash chemicals available supplies of caustic potash are being steadily absorbed in the priority channels of consumption. Yellow prussiate of potash continues in short supply and high prices are being indicated. Supplies of bichromate of potash are being

fully absorbed, while acid phosphate of potash is a good market. White powdered arsenic is a good section, and a steady demand is reported for British-made formaldehyde. Active conditions are reported in the coal-tar products market and pitch is in good demand for home consumption.

MANCHESTER.—Quotations remain strong for heavy chemicals, and little actual movement has occurred. There has been a certain amount of new inquiry about during the past week, and this has resulted in moderate additions to order-books, though the current movement of supplies of the alkalis and most other materials is principally against contracts. Traders indicate relatively quiet conditions in the tar-products section so far as fresh bookings are concerned, though here again there has been little ground for complaint regarding contract deliveries. This week's new control order affects the prices of benzol and certain other light distillates.

GLASGOW.—In the Scottish heavy chemical trade business has been rather quieter during the past week for the home market. Export trade remains rather restricted.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

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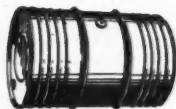
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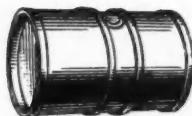
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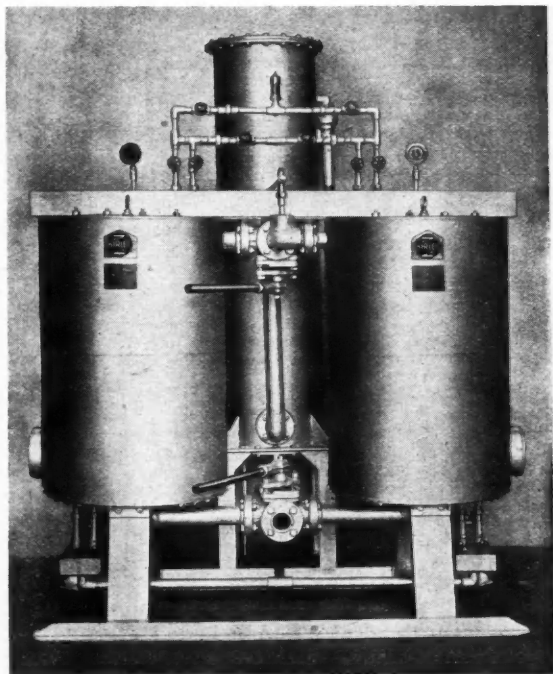
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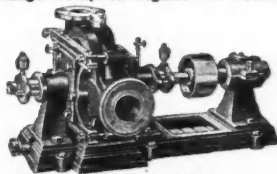
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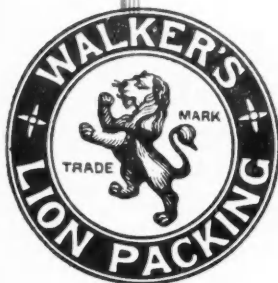
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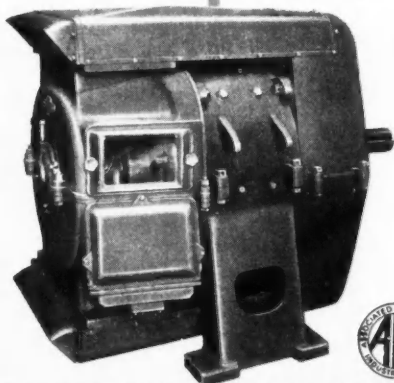
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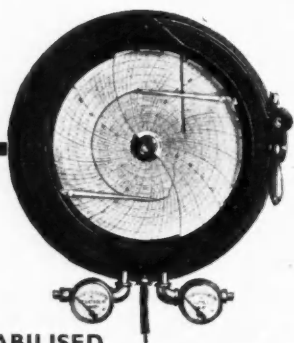


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